Astronaut Ascent/Entry Trainer adds to crew training tools

By Nicole Cloutier

Easier access, quicker simulation turnaround time, and improved crew training are just some of the benefits evolving from a desktop shuttle simulator developed by JSC's Rapid Prototyping and Interface Development (RaPID) Lab.

Known as the Astronaut Ascent/Entry Trainer, the simulator designed to provide astronauts with an easily accessible tool to maintain proficiency in ascent and entry flight procedures is getting rave reviews from astronauts and trainers alike.

"It's a great training tool," said JSC Associate Director (Technical) John Young, a frequent user of the AET. "I just ran the latest trajectories for STS-99 on it and it truly is an advance in terms of what we can do with our computer technology and the skilled team we have here working on the software."

Prior to the AET, training for ascent and entry flight procedures was primarily based on the Shuttle Mission Simulator. Although it provides very valuable training, the SMS is in high demand for its limited operating hours and requires advance scheduling and significant personnel support.

"We needed something to augment the training for the dynamic procedures," said Col. Charlie Precourt, chief, Astronaut Office, who initiated development of the trainer from the Astronaut Office and later contacted the RaPID Lab to tie in their expertise. "We wanted a trainer that would include all the Guidance Navigation and Control procedures such as RTLS aborts, TAL aborts and high and low energy entry procedures."

With that in mind the RaPID Lab designers went to work and delivered a product that can simulate space shuttle ascents and entries on a desktop computer. Astronauts can practice nominal ascents and intact aborts, contingency aborts, entries, and TAEM flight procedures.

"The AET is truly a team production," said Jeff Bertsch, chief of MOD's Technology Applications Office, home of the RaPID Lab. "Although the initial software development was a small RaPID Lab project, the AET is actually a collaboration of ideas and technologies from many organizations. The Astronaut Office, Engineering Directorate and MOD worked together to make the AET a reality. A major goal in the development of the AET was to capitalize on existing tools and commercially available technology as much as possible."

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The AET development team, from left , front: Mason Menninger, USA, Shashi Srinivasa, Jaymark Engineering, Francis Choi, USA, and back: Tom Smith, Barrios, Daniel Deger, NASA and Jeff Bertsch, NASA.

The AET space shuttle simulation is based upon the Ascent/Entry Shuttle Engineering Simulation developed and maintained by the Engineering Directorate. The cockpit and crew interfaces were developed using VAPS, a commercial product for cockpit display and user interfaces. The visual scenes were also developed using commercial products for 3D-image generation on Silicon Graphics computers. The AET is equipped with a specially designed hand-controller to emulate the shuttle's Rotational Hand Controller.

Available to astronauts 24 hours a day, the AET resides on a Silicon Graphics desktop computer in Bldg. 4S. This allows the astronaut corps, including ASCANs, to utilize a trainer without a full support team and to exercise repetitive training without being "graded."

"Our crews will be a lot better qualified for flight because of these trainers," said Young. "They can run it as often as they want, quickly and fly to any of the landing sites."

Developers integrated high-resolution visuals and Landsat images of shuttle landing sites with elevation data to depict realistic landing environments. Astronauts can specify a desired landing site and familiarize themselves with contingency landing locations and procedures.

The astronaut also can select an ascent or entry simulation, fast forward to critical stages and customize various simulation parameters such as desired inclination, launch date/time, launch slip, and wind profile direction and strength.

"The crew will be able to learn so much more from the AET about what is really occurring during ascent and entry," continued Young. "As compared to the vehicle itself, where you have to use a scan pattern around the entire cockpit, with AET all of the information is available right on the screen."

Other AET features include manual or auto flight control for ascent, abort or entry; ability to mimic SSME, APU, RCS and engine failures and stuck throttles for ascent abort scenarios; and stowing guidance error needles for manual flight training.

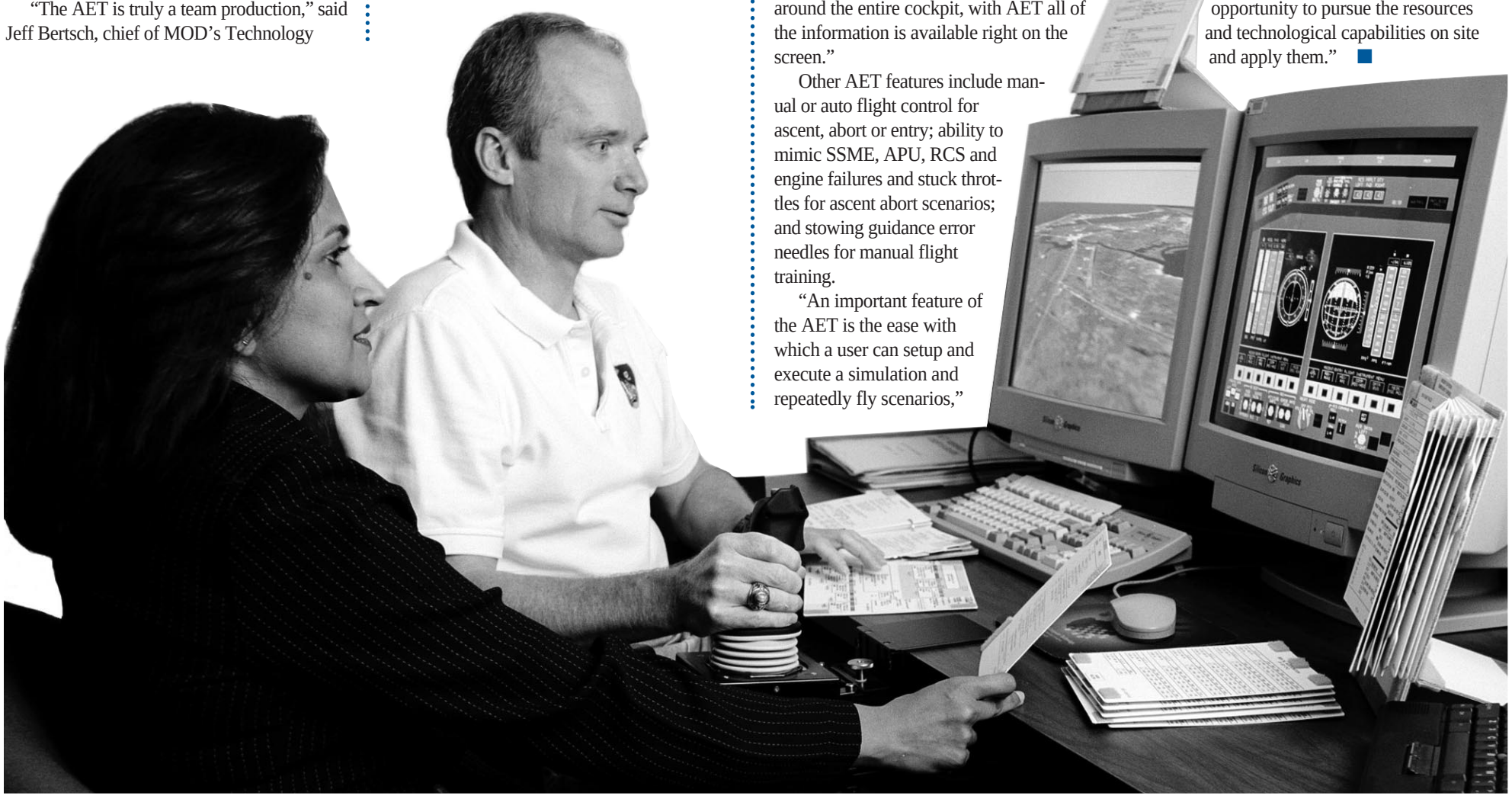
"An important feature of the AET is the ease with which a user can setup and execute a simulation and repeatedly fly scenarios," said Bertsch. "This enables the astronaut or instructor to quickly repeat difficult procedures and build proficiency in critical phases of flight."

The AET's success has prompted crew instructors to incorporate it into the astronaut training catalog, transferring some training requirements from the larger simulators. Although it was not developed with the intention of reducing crew-training costs, developers estimate that approximately 112 hours of crew training per year can be achieved on the AET. This will reduce time and man-hours needed on the larger simulators.

"We have discovered another tangible benefit of the AET – it makes a great demonstration for NASA public outreach initiatives," added Bertsch. "We have worked with the Public Affairs Office and Inspection Day teams to provide the AET at a number of conferences and expositions. It is always extremely popular with the public as they get an opportunity to actually 'fly' the space shuttle. We took it to the NASA pavilion at the Experimental Aircraft Association's convention in Oshkosh, Wisconsin, this year. It was a very popular attraction for JSC."

What are the future plans for the AET? Precourt hopes to be able to offload more training from the SMS to the AET. They also plan to implement deorbit burns and possibly tie the AET into a network with similar trainers for flight controllers, which may enable them to have small scale "integrated" flight simulations without incurring full Mission Control simulations.

"FCOD and MOD really worked together and produced a cost effective means to improve training. It's a good example of a concept that we should apply throughout the site, on other training programs," said Precourt. "We should take every opportunity to pursue the resources and technological capabilities on site and apply them." ■



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Shashi Srinivasa, the Ascent/Entry Trainer project lead, and Astronaut Charlie Precourt try out new features to the AET in Bldg. 4S.